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(54) Twin piston, commutator motor driven, high pressure pump for hydrocleaning equipment.

(57) The pump is driven by a high speed commutator type motor the shaft (24) of which is directly connected to a swash plate (30) which actuates two small ceramic pistons (34,36) set at 180°. The by-pass valve (54) is housed between the two pistons. The springs of the input and output valves (50,52) are not housed within a retaining cage but located directly in the elongation of the bore in which reciprocate the pistons. Owing to the high rotational speed of the motor no delivery pressure drops occur thus obviating the need to foresee pressure accumulators. Overall, the pump is very compact and lightweight because of the type of motor adopted and the miniaturisation and optimisation of fundamental components.

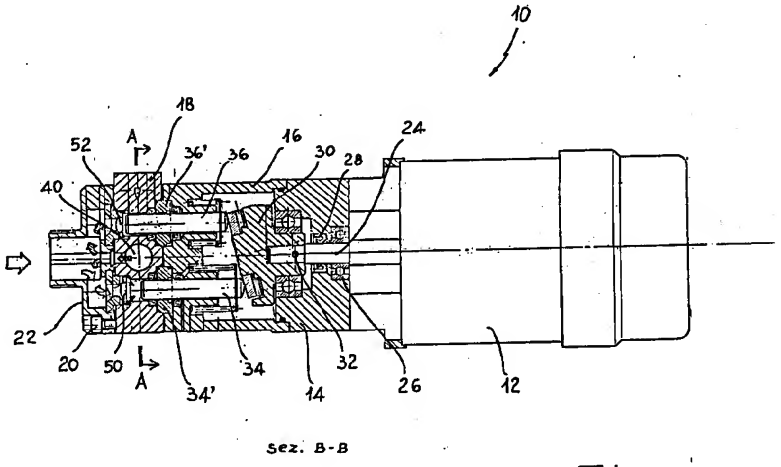

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Fig. 2

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The following description is referred to the invention of a high pressure pump operated by two pistons, driven by a commutator type electric motor and particularly suited for powering equipment that employs a water-jet as the cleaning media (Hydrocleaning Equipment).

Manufacturers of electrically driven hydrocleaning equipment for industrial or for do-it-yourself applications take into careful consideration problems related to the continuity of delivery, usually water, and the vibrations generated by the propelling system.

Traditional pumps equipped with 3 axial pistons set at 120° provide satisfactory results and this approach proves to be the best and most frequent technique to obtain an acceptable compromise between delivery rate and vibrations. Such design solutions often rely on electrical induction motors, running at relatively low RPMs. However, as this type of structural solution is rather bulky and heavy, mainly because of the size and number of pistons, usage potentialities are often limited and not without problems.

With the intention of eliminating said limitations, hydrocleaning pumps operating through the 180° pistons have been designed without fully providing a solution, as a smooth water delivery output has not been realised. The adoption of such basic solution does in fact provide a delivery alternating between maximum flow and practically zero flow. To obviate to such inconvenience, designers must introduce pressure accumulators which, if on the one hand smooth out the flow rate, on the other not only complicate the device, but contribute to the increase of unit costs.

Even with this approach, the introduction of additional components neither contributes to the overall compactness of the device nor provides a valid cost effective alternative.

The purpose of the subject invention is that of realising an extremely compact, small size, low weight pump specific for hydrocleaning devices capable of assuring constant water flow rate characteristics.

The realisation of an easily manufactured and assembled low cost pump, such as described above, constitutes an additional finality of the invention. This and other finalities are satisfied by the subject pump which is basically characterised by two pistons operating at 180° and actuated by a swash plate on direct drive from the shaft of a commutator-type, high-speed, electric motor. The compact by-pass valve, ideally located between the two pistons, takes up little space and contributes in good measure in limiting the overall dimensions of the pump.

Further characteristics and advantages offered by the invention will become apparent from the description of a type of realisation, illustrative but not restrictive, of the pump as per the invention. The description makes reference to the drawings contained in the attached figures:

Fig. 1 - Pump, Cross Section View

Fig. 2 - Pump, Longitudinal Section View.

With reference to Fig 2, the high pressure pump identified as the assembly 10, is basically an elongated cylindrical structure, the right hand side of which contains the housing 12 for a driving device, preferably an electric motor of the distributor type, and a central portion made up by a flange 14 and an integral casing and a left hand portion consisting of headpiece 18 to which the output manifold 22 is attached by screws 20.

The end of the shaft 24 of the motor housed in 12 extends into flange 14 in which it is supported by bearing 26 and lubrication sealing ring 28. Spline 32 transmits drive from the motor shaft 24 to the swash plate 30 which induces axial movement to pistons 34 and 36 to compress the fluid ducted through orifice 38 (Fig. 1) finally utilized by a spray gun (not shown) for cleaning purposes. As can be seen in Fig. 2, no speed reduction devices are present between motor shaft 24 arid swash plate 30 that actuates with reciprocating motion pistons 34 and 36, guided in their travel by rings 34' and 36'. Pressure accumulators have not been introduced in the circuit, as the adoption of a distributor-type electric motor, running at an indicative speed of between 6,000 and 10,000 RPM, prevents fluctuations in the water delivery pressure, thus obviating the use of said accumulators.

In addition to the advantages provided by the above mentioned structural approach, it can be stated that:

- the pistons (2 only, set at 180° angle) can be of very small cross section, helping considerably to keep down the size of the assembly, notwithstanding the high operating speed;
- the same pistons, limited in number and dimensions, can be advantageously made of such costly material (i.e. ceramic) capable of enhancing product quality and durability, without appreciably increasing manufacturing costs;
- the resulting pump assembly displays appreciable characteristics of small weight and size, made possible by the insertion of a by-pass valve (schematically represented in Figs. 1 and 2) between pistons 34 and 36, with the obvious saving of space. It is to be pointed out that the one-way input valves 50 arid 52 and/or the output valves 62 and 64 are of a simplified innovative design: in fact, the traditional retaining and guiding cages for

the corresponding springs are no longer required and the springs are now retained in precise housings obtained by suitably elongating the piston chambers, that is, in ducts similarly structured connected to the chambers themselves.

Considered the basic requirements of miniaturising the assembly by reducing the dimensions and the weights of the overall group (and of the individual components) without moreover reducing neither the efficiency nor the operational output, the result is a positive improvement, as compared to traditional pumps of equivalent type.

For the purpose of describing the operation and with reference to Fig. 1, normal water flow is shown by white arrows. During usage, with the spar gun activated and non-return valve 24 open, water exits from output port 38 under pressure to feed the spray gun.

Fig. 2 illustrates schematically that with piston 34 in the fully withdrawn position, input valve 50 open and output valve 62 closed, the related compression chamber fills.

Piston 36 is shown instead in the fully advanced position with the related input valve 54 closed and output valve 64 open. In this condition, the compressed water present in the compression chamber of cylinder head 18 is channelled through output manifold 22 to the user gun.

If the position of pistons 34 and 36 is reversed, the cycle is obviously reversed.

Still referring to Fig. 1, can be seen that the shaded arrows identify the water flow when the spray gun in not activated: ball non-return valve 54 is open. In this condition a back pressure is set up, as shown by black arrows, that causes non-return valve 42 to close and, via the pressure release duct 56, plunger 58 is forced to rise which in turn acts on ball 54 that opens up the by-pass flow path 60 towards output manifold 22 (on Fig. 2). Resulting operation is that the pump continues to rotate and pumps the water present in the cylinder heads without delivering it to the exhaust.

As can be determined by what mentioned previously, the advantages offered by the invention are several.

The utilisation of a commutator motor, smaller and lighter as compared to an equivalent induction motor, contributes to the reduction of size and weight. If the aspect of size and weight is compared with that of a traditional pump of equal rate of flow (between 6.5 arid 7 litre/min) it results higher than 50 per cent.

Moreover, when the size of the pump is particularly contained, the amount of sound proofing material can be increased to reduce noise emission from the assembly.

The pump, structured as described, considered the high rate of motor RPMs, does not show reduction of the flow of water even if only operating with two pistons.

The invention, as heretofore described and further on claimed, has been proposed purely as an example, meaning that it may by subjected to changes and modifications, all within the scope and intentions of the invention.

Merely to offer examples, the pump may be equipped with two pistons of materials different from ceramic or be driven by an electric motor different from a commutator motor or even types of internal combustion engines.

Claims

1. High pressure pump suited for hydrocleaning equipment, is characterised by two pistons (34 - 36) set at a relative angle of 180° and actuated by a swash plate (30) being direct drive coupled to the shaft (24) of a high speed electric motor, of the commutator type, housed in (12).

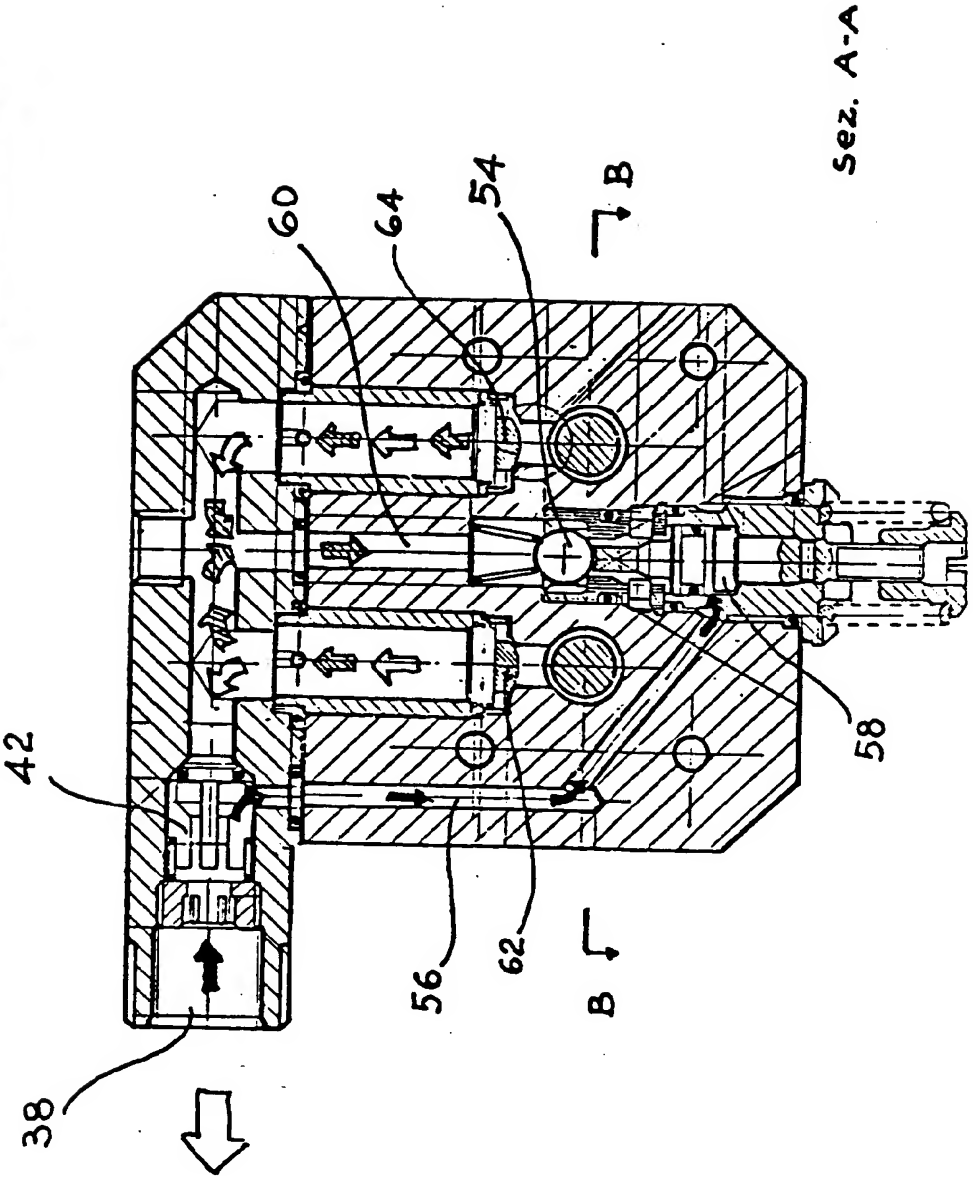
2. High pressure pump as described at point 1 above, is characterised by the fact that the pistons (34 - 36) are realised of sintered ceramic material and a by-pass valve (40) is mounted between them.

3. High pressure pump as described at points 1 and 2 above, is characterised by the fact that the springs of the one-way input valves (50 - 52) and/or the output valves (52 - 64) are placed in and guided by their positioning in the suitably dimensioned extension of the chambers inside which pistons (34 - 36) operate, these being the ducts similarly structured connected to the chambers themselves.

4. High pressure pump as described at points 1, 2 arid 3 above, is characterised by the fact that is contains a duct (56) in which, with non-return valve (42) closed, a back pressure is determined to move ball (54) of the by-pass valve. This puts path of duct (60) and input manifold (22) in communication and causes the water present in cylinder head (18) to recycle.

5. High pressure pump consisting of two pistons and electric commutator motor, suitable for hydrocleaning equipment, as described, illustrated for descriptive and for specified purposes.

FIG. 1



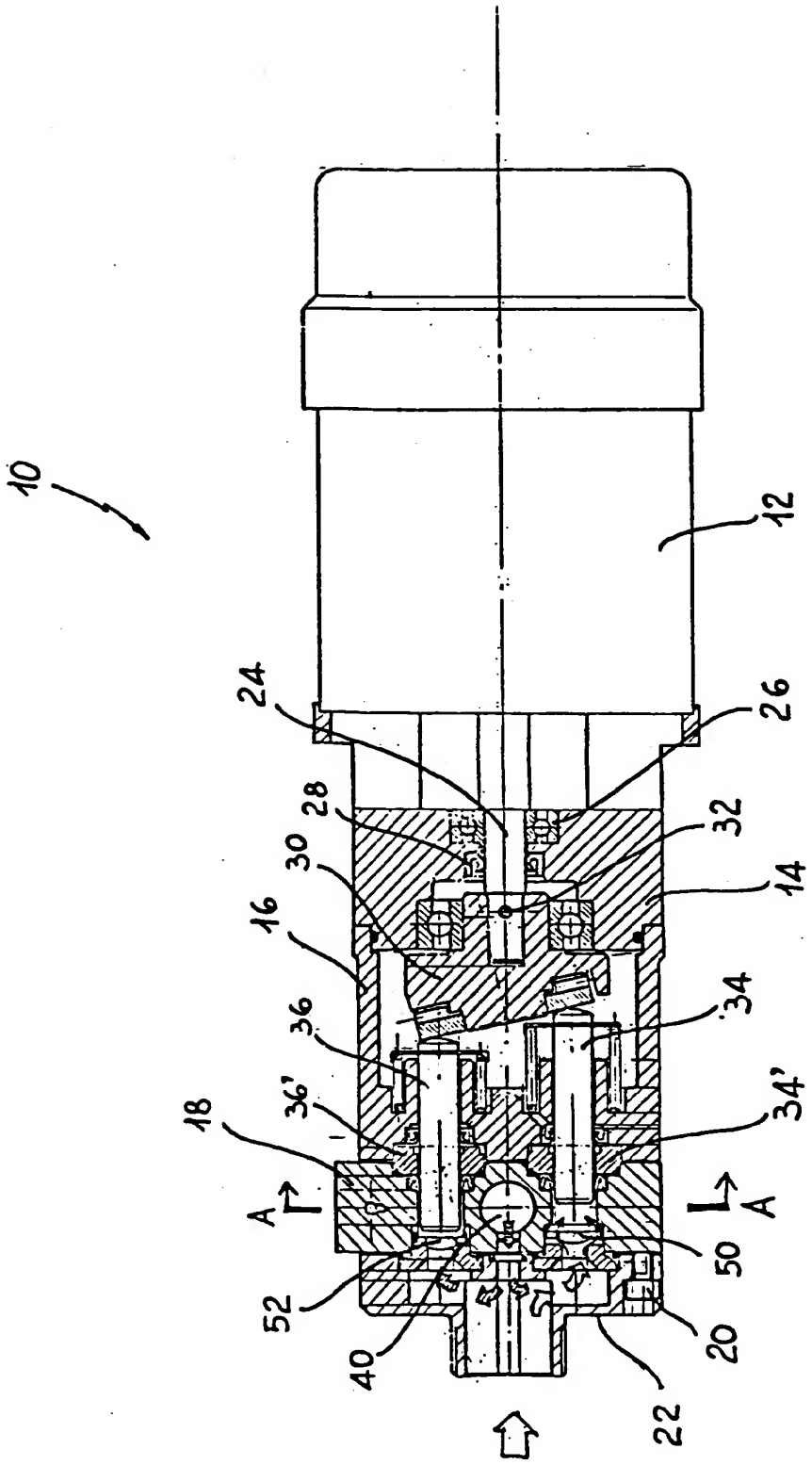


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FIG. 2

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EUROPEAN SEARCH REPORT

Application Number

EP 91 11 8208

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	US-A-3 954 048 (HOUSER) * column 2, line 14 - line 63; figure 2 *	1	F04B1/14 F04B17/00 F04B1/12
Y	EP-A-0 221 304 (SIEMENS) * claim 1; figure 1 *	1	F04B49/00
A	WO-A-8 400 403 (SAUDER) * page 9, line 16 - page 10, line 5; figure 1 * * page 3, line 21 - page 4, line 23 *	1,3	
A	EP-A-0 149 219 (SPECK-KOLBENPUMPEN) * page 5, paragraph 4 - page 8, paragraph 2; figure 1 *	1-3	
A	FR-A-1 201 441 (R .E .P.) * page 1, left column, paragraph 4 - page 2, left column, paragraph 1; figure 1 *	1,2,4	
A	FR-A-2 618 187 (GILARDINI)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F04B
H02K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	03 FEBRUARY 1992	BERTRAND G.

CATEGORY OF CITED DOCUMENTS

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